Mansoura University		Department: Electronics and Communications Engineering Dept. Total Marks: 100 Marks	Faculty of Engineering

Course Title: Electromagnetic Fields	Course Code: COM 9213	Year: 2rd
Date: Jan, 2013 (First term)	Allowed time: (3) hrs	No. of Pages: (1)

Remarks: (*Answer the following questions, assuming any missing data*)

Problem number (1) **(20 Marks)**

a- A uniform line charge of $\rho_l = 2\pi$ nC/m lies along the y axis, while uniform surface charge densities of + 0.1 and - 0.1 nC/m2 exist on the planes z = 3 m and z = - 4 m, respectively. Find E at the point P(1,-7,2). At which point is E the negative of the field at P?

b- Let $E=5x^3a_x - 15\ x^2y\ a_y$, find the equation of the streamline that passes through P(4,2,1).

Problem number (2) **(20 Marks)**

Within the spherical shell, 3<r<4 m, the electric flux density is given as $D= 5(r-3)^3\ a_r\ C/m^2$.

(a) What is the volume charge density at r = 4 m?
(b) What is the electric flux density at r=4 m?
(c) How much electric flux leaves the sphere r=4 m?
(d) How much charge is contained within the sphere r=4 m?

Problem number (3) **(15 Marks)**

A spherical region of space of radius R contains a charge Q that is distributed uniformly with constant volume charge density $\rho\ C/m^3$.

(a) Determine the stored electrostatic energy.
(b) Compare it to the energy of two point charges Q that are separated by a distance R.

Problem number (4) **(15 Marks)**

A dipole with moment $P = 0.1\ a_z\ \mu C.m$ is located at A (1,0,0) in free space and the plane x = 0 is perfectly conducting. Find the potential at the point p (2,0,1).

Problem number (5) **(15 Marks)**

Find the capacitance and electric field intensity for the region between two concentric right circular cylinders, where V = 0 at ρ = 1 mm and V = 150 V at ρ = 20 mm.

Problem number (6) **(15 Marks)**

a- Write Maxwell equations fields in its integral form.

b- The point charge Q = 18 nC has a velocity of 5×10^6 m/s in the direction $0.04\ \mathbf{a}_x - 0.05\ \mathbf{a}_y + 0.2\ \mathbf{a}_z$. Calculate the magnitude of the force exerted on the charge by the field:

(a) $\mathbf{B} = -3\ \mathbf{a}_x + 4\ \mathbf{a}_y + 6\ \mathbf{a}_z$ mT.
(b) $\mathbf{E} = -3\ \mathbf{a}_x + 4\ \mathbf{a}_y + 6\ \mathbf{a}_z$ KV/m.
(c) **B** and **E** acting together.

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Course Examination Committee

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